vikramsolar®
vision in action

Installation Manual

(ULTIMA SERIES)

APPLICABLE MODELS

Eldora **VSP**.60.AAA.03
(AAA=240-260)

Eldora **VSPB**.60.AAA.03
(AAA=240-260)

Eldora **VSPBB**.60.AAA.03
(AAA=240-260)

IEC VERSION

This manual applies exclusively to IEC-certified PV modules.

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01. DISCLAIMER OF LIABILITY

- The use of this manual, the installation, and the handling of Vikram Solar modules are beyond Vikram Solar's control. Vikram Solar assumes no responsibility for failure to follow instructions resulting in any loss, damage, injury or expense due to improper installation, handling, usage or maintenance.
- Vikram Solar assumes no responsibility for the infringement of intellectual property rights or other rights of third parties that may result from use of the module. No license is granted in this regard, either expressly or implicitly, nor under any patent rights.
- All information given in this manual is based on Vikram Solar's knowledge and experience. Vikram Solar reserves the right to change this manual and module specification without prior notice.

02. SAFETY PRECAUTIONS

- PV modules generate electricity upon direct exposure to light, which can result in electric shock. Use of insulated tools and gloves is recommended while working with modules in sunlight. No metallic contact points should be on the human body.
- No one should stand on the front and or rear surfaces of the PV module, as non-uniform, localized pressure might cause damage to the solar cells inside the module.
- The front surface of the module is constructed with tempered glass and hence it should be handled with the utmost care. If the glass breaks, human contact with the surface can lead to electric shock, particularly when the ambient conditions are wet. Broken modules cannot be repaired and should be disposed of properly.
- All electrical connectors should be well protected against corrosion and soiling. Ensure that connectors are corrosion free and clean with absolutely no gaps between the contacts. Gaps can result in electrical arcing causing a fire hazard.
- For your personal safety, do not install/handle PV modules in adverse environmental conditions such as gusty winds or wet frosted roof surfaces.
- Ensure the polarity of the modules or strings is not reversed in relation to the other modules in the string.
- Concentrating artificial sunlight on solar modules is not allowed as it will degrade their performance and life span.
- Vikram Solar modules are certified for operation in Class A installations at voltages below 1000V DC. This value should be taken into consideration when designing the power plant, as should the temperature ranges present at the site. The mixing of power classes in one string is not allowed and can be harmful. Damage to modules due to such mixing can lead to the invalidity of product warranties.
- Under normal conditions, a photovoltaic module is likely to produce more current and/or voltage than reported under standard test conditions, as the environmental conditions are different in each location. Reflections from snow and water can increase the sunlight intensity, which in turn augments current and power. The Isc value should be multiplied by 1.25 when determining the conductor current ratings, fuse sizes, and the size of controls connected to SPV output.

03. UNPACKING AND STORAGE

- Upon receipt of the PV modules, verify that the product details correspond to those ordered. The packing list affixed to the outside of the box contains all details including the serial numbers of the modules.
- Do NOT stack packing boxes (pallets) more than 2 boxes high. If pallets are temporarily stored outside, an external protective cover should be placed over them and the stack height should not be more than 1 pallet high.
- PV modules should always be unpacked vertically by two people as shown in the diagram. Care should also be taken to prevent one module falling over and knocking another inside the packaging box.
- PV module surfaces may become damaged/scratched if not handled carefully. No paint or adhesive should be applied to any of the surfaces including frames.
- Do NOT connect the male & female connectors of the junction box to the cable of the module.

Fig 1 Correct way to unpack modules

03.1 MODULE IDENTIFICATION

Each module has a unique serial number, which is laminated behind the glass. Please do not tamper with the serial number of the module and always record all serial numbers in an installation for your future records.

04. INSTALLATION ENVIRONMENT

04.1 CLIMATE CONDITIONS

- Vikram Solar modules are certified to *IEC 61701, IEC 62716, IEC 62804-Draft-1, IEC 61215, IEC 61730-II.* The modules are qualified for application Class A. Modules qualified for safety through IEC 61730 within this application class are considered to meet the requirements of Safety Class II. In addition to the IEC certification required to meet European standards, Vikram Solar products have also been tested and certified for resistance to ammonia fumes that may be present in barns housing cattle or pigs, as well as for their suitability for installation in humid (coastal) areas that experience extreme sand storms. Although Vikram Solar's PV modules have passed IEC 61701 salt mist corrosion tests with a salt concentration of 5% by weight, galvanic corrosion can occur between the aluminum frame and mounting or ground materials if such materials are made of dissimilar metals. Direct contact between stainless steel and aluminum is therefore not recommended for seaside installations to avoid metal corrosion.

*** NOTE:**

IEC 61215 and IEC 61730-II are completed. The other certifications are in progress.

ENVIRONMENT

- Ambient temperature: -40°C to +50°C.
- Operating temperature: -40°C to +85°C.
- Storage temperature: -20°C to +50°C.
- Humidity: < 85 RH%
- Mechanical load pressure*: 5400 Pa on the front and 2400 Pa on the rear

*** NOTE:**

The mechanical load bearing capacity depends upon the installer's mounting methods and failure to follow the instructions in this manual may result in different capabilities to withstand snow and wind loads. The system installer should ensure that the installation methods used meet these requirements as well as any local codes and regulations.

05. SITE SELECTION

- PV modules should be installed in a place where no shading occurs throughout the year. Shading can be minimized by ensuring that the distance between an obstruction and the solar array is more than three times the height of the obstruction.
- PV modules should typically face south in the northern hemisphere and north in the southern hemisphere. Vikram Solar modules can be mounted either in landscape or portrait orientation, however the impact of dirt shading the solar cells can be minimized by selecting portrait orientation.
- For optimum energy production, solar modules should normally be mounted facing the equator at an angle to the horizontal plane equivalent to the latitude of the installation. If the PV module is placed at a different angle or orientation, this could have a direct impact on the power output.
- An inclination of less than 1: 2.4 is required to maintain the fire class rating.
- Avoid using mounting methods where drainage holes are blocked.
- PV modules should not be installed in such a way that they will be immersed under water under any circumstances, and should also not be installed on moving vehicles/vessels.

06. MOUNTING INSTRUCTIONS

06.1 MOUNTING METHODS

Corrosion proof M6 bolts are to be used in the PV module mounting holes, which are on the rear side of the module. PV modules can be fixed using either the bolt method or clamp method. Regardless of the mounting method, the installer should ensure that:

- 120mm clearance is provided between module frames and the surface of the roof or the wall.
- There is a minimum distance of 10.5mm between 2 modules.
- Drainage holes are not blocked under any circumstances.

PV modules are not to be subjected to wind or snow loads exceeding the maximum permissible loads, and should not be subjected to excessive forces due to the thermal expansion of support structures. When modules are ground mounted, select the height of the mounting system in such a way as to prevent the lowest edge of the module from being covered by snow for a long time in winter in areas that experience severe snow fall. If snow settles on the PV modules, the regular clearing of snow and other foreign particles is highly recommended to ensure the long-term reliability of the PV modules. Failure to comply may result in damage to the module and lead to deformation not covered under warranty.

➔ MOUNTING WITH FRAME BOLT HOLES

The frames of each module have 8*(6.5mm*10mm) mounting holes. Vikram Solar strongly recommends the use of corrosion-proof (stainless steel) fixings. The modules are to be secured with an M6 bolt, and a flat washer or spring washer and nut as shown in the figure. The assembly should be tightened to a torque of at least 16-25Nm.

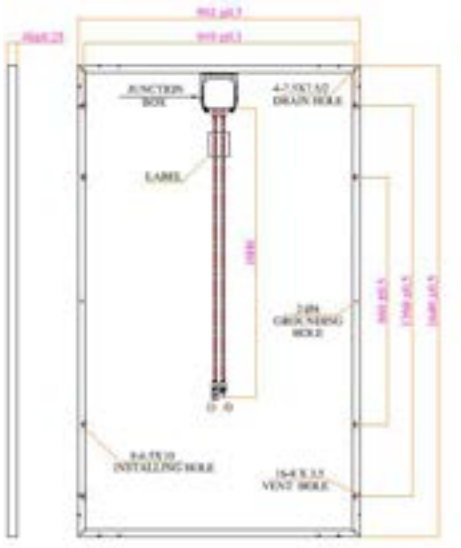


Fig 2 Mechanical drawing of PV module Eldora VSP.60.AAA.03 & Eldora VSPB.60.AAA.03 & Eldora VSPBB.60.AAA.0

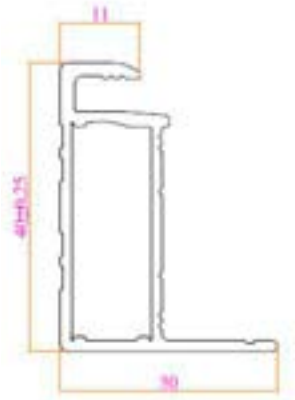


Fig 3 Sectional view of Al profile

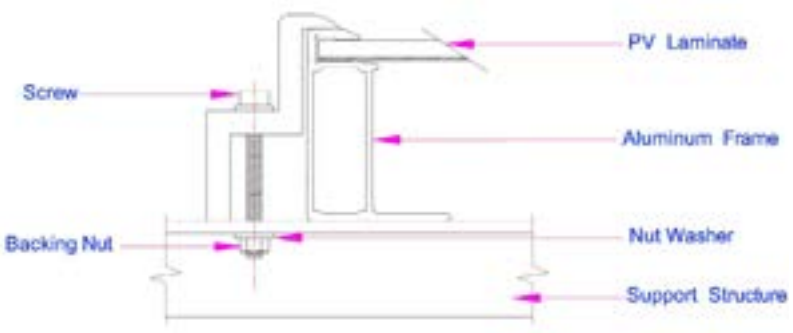


Fig 4 Modules installed using screw fitting method

B. MOUNTING WITH CLAMP FIXING

- Vikram Solar has tested modules with a number of clamps and suggests using clamps which have an EPDM or any other insulating washer.
- To fix the modules on the mounting rail, a minimum of 4 clamps must be used.
- The clamps should never touch the glass and cause any breakage, and clamps should also not cause any shading effects on the module.
- The customer should not modify the frame under any circumstances.
- When modules are mounted using the clamp mounting method, at least 4 clamps need to be used. 2 clamps on each long side of the module and 2 clamps on each short side of the module. Vikram Solar modules are certified to bear 2400 Pa (Wind Load) and 5400 Pa (Snow Load) on the front side. Additional clamps can be used to ensure that modules are able to bear the load.

Fringe position module installation and middle module installation diagrams are given below

FRINGE MODULE INSTALLATION

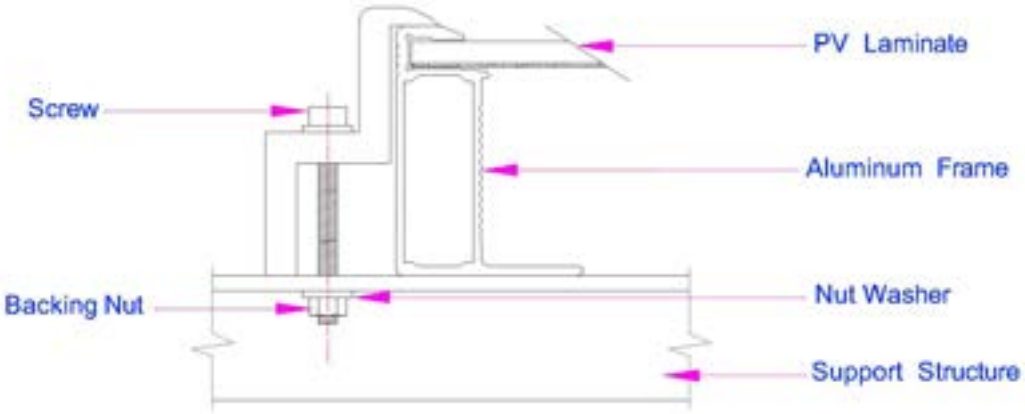


Fig 5 PV modules installed using fringe clamping method

MIDDLE MODULE INSTALLATION

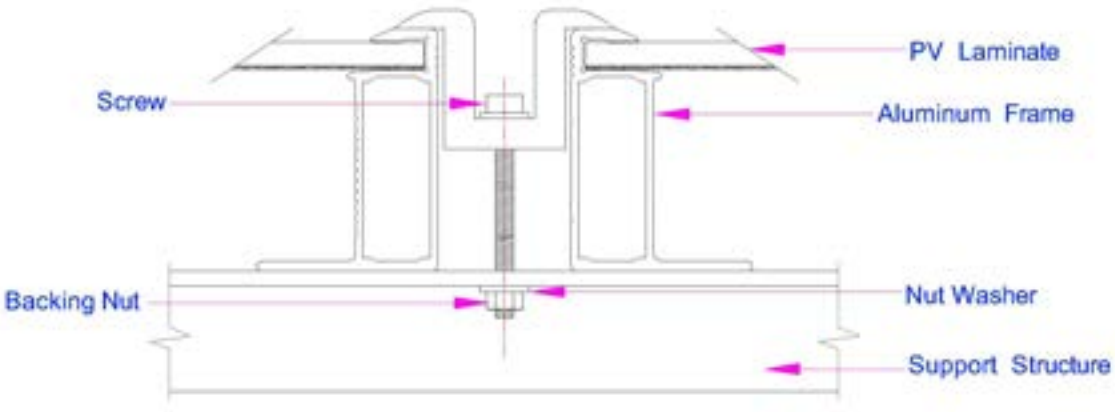
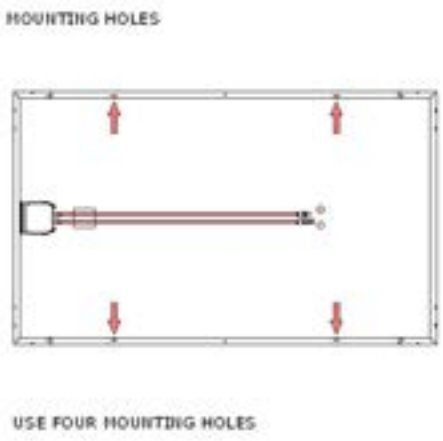
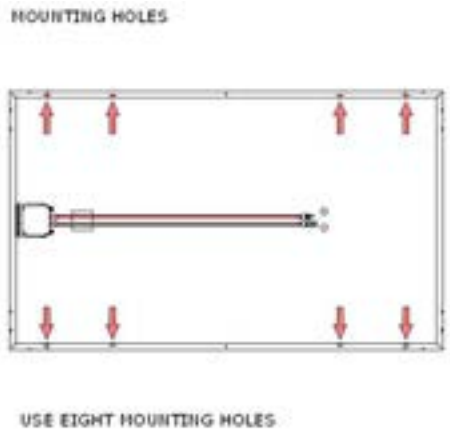
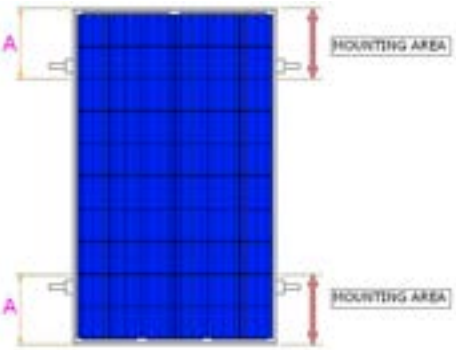
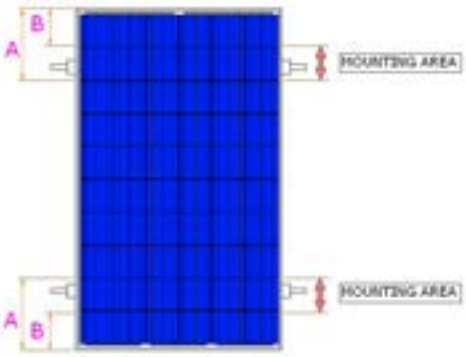
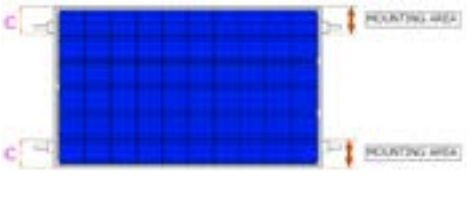
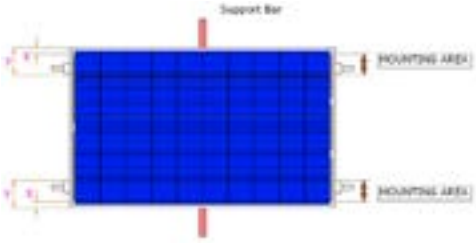


Fig 6 Middle modules installed using clamping method

Type of mounting method	2400 Pa load condition	5400 Pa load condition
Bolt type mounting system		
Clamp system: attachment to the **long side of the frame**		
Clamp system: attachment to the **short side of the frame**	 Mounting rails should run parallel to the short side of the frame. If the expected load is greater than 1600 Pa, a support bar should be inserted.	 Mounting rails should run parallel to the short side of the frame. An additional support bar should be used below the module.

Dimensions depending on module type (mm)	Cell & cell size	Model name	Length	Width	x	y	A	B	C
	60 Cell, "6" Cell Module	Eldora VSP.60.AAA.03 & Eldora VSPB.60.AAA.03 & Eldora VSPBB.60.AAA.03 (where AAA=240-260)	1640	949	47.45	189.8	410	205	237.25

Different mounting configurations can be tried, as per the installer's calculations, however failure to comply with the above instructions will result in a lowering of load handling capabilities and may lead to failure in overload situations, which may not be covered under the product warranty.

06.2 GROUNDING

- All module mounting frames and mounting racks need to be grounded according to the respective national electric codes (NEC). The module frame must be properly grounded (refer to NEC clause 250). The grounding wire must be properly fastened to the module frame to ensure good electrical contact. Use the recommended connector type, or an equivalent, for this wire.
- If the support frame is made of metal, the surface of the frame must be electroplated and have excellent conductivity.
- First, carefully strip 16mm of the insulating jacket from the end of grounding wire to avoid nicking or cutting conductors, insert the wire into the slot of the lug (see picture), and screw down the slotted screw.
- For grounding and bonding requirements, please refer to regional and national safety and electricity standards. If grounding is required, use a recommended connector type, or an equivalent, for the grounding wire.
- If grounding is required, the grounding wire must be properly fastened to the module frame to ensure adequate electrical connection. The grounding conductor must then make a connection to earth using a suitable ground electrode.

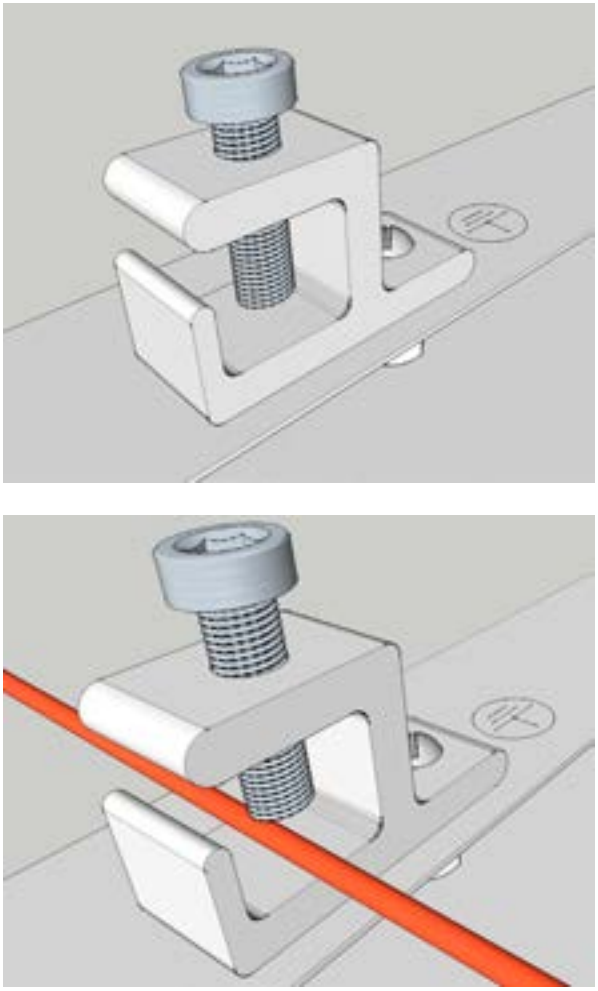


Fig 7 Grounding assembly of PV module

- Vikram Solar modules can be installed with the grounding devices manufactured by third parties and listed for the grounding of metal PV module frames. The devices must be installed in accordance with instructions specified by the grounding device manufacturer.

06.3 MODULE WIRING

- Module wiring should be performed by professional expert installers in accordance with local regulations and national codes.
- PV modules can be connected in series to obtain an increase in the operating voltage. The positive connector plug of the module is pushed into the negative connector plug of another module until a click is heard. Only assume the modules are connected if a click is heard.
- Irreparable damage can be done if the array strings are connected in reverse polarity, i.e. if the positive end is connected to negative input of the string combiner box and vice versa. Proper connection in the right polarity is therefore recommended, and if any reverse polarity is seen or any difference of more than 10V is observed, the string configuration connection needs to be checked and connected appropriately.
- Vikram Solar modules are provided with standard copper cables with a 4mm^2 cross-sectional area and are rated at 1000V (TUV), 600V (UL) for maximum system voltage, 90oC and are UV-resistant. Ensure the cables are not exposed to water-logged areas.
- The maximum voltage of the system should be less than the certified system voltage (typically 1000V) or the maximum input voltage of the inverter. Since Voc α (1/T), the open circuit voltage of the array needs to be calculated at the lowest ambient temperature for the location of power plant.

  This can be done using the formula below:

  System voltage = X * Voc * [1 + ((Tα-voc(%) × (25 – Tmin))]

  WHERE

  X - Number of modules which are connected in series
  Voc - Open circuit voltage of each module (refer to the data sheet)
  Tα-voc - Thermal coefficient of open circuit voltage for the module as a percentage (refer to Vikram Solar spec sheet)
  Tmin - Minimum ambient temperature of the location of the plant

- The minimum and maximum outer diameters of the cable are 5mm^2 and 7mm^2.
- For field connections, please use 4mm^2 cables insulated for a minimum of 900C and designated as PV wire.
- The minimum bending radius of our junction box cables is 42mm.

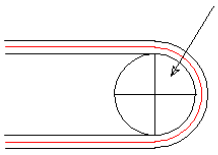


Fig 8 Bend radius

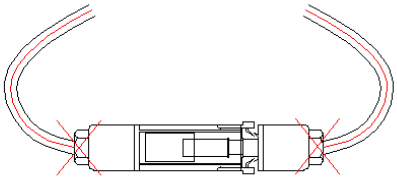


Fig 9 Incorrect cable routing

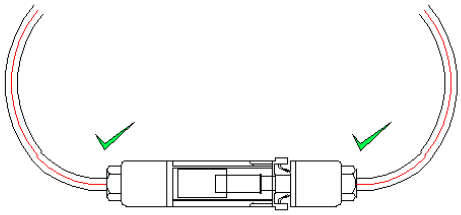


Fig 10 Correct cable routing

07. ELECTRICAL CONFIGURATION

A solar array generates DC electricity when sunlight falls on the modules and the inverter is in active mode. Once the minimum voltage and current requirements are met, this is converted into AC power accordingly.

CAUTION:

- The modules are rated to operate at potentially lethal DC voltages which have the potential to cause severe electric hazards in the form of shock, arcing and other fire hazards. Hence only trained professionals are permitted to work with the modules, the DC solar array and the DC combiner box. The PV modules are certified to operate at 1000V DC.
- A rated isolator (DC switch) must always be used to interrupt the current flow when disconnecting the connectors. Even after disconnecting, the DC power may be active for some time, hence only expert operators are recommended to work with the modules, string combiner box, etc. Vikram Solar will not be held responsible for any electrical accidents occurring in power plants with Vikram Solar modules.

07.1 FUSING

Please rate the fuses for maximum V DC and connect them in each non-grounded pole of the solar array. (If the system is a floating system, fuses should be connected in both positive and negative poles).

The maximum fuse rating connected in series with the array string is usually 15 A, but the actual module specific rating can be found on the module data sheet. The fuse rating also corresponds to the maximum reverse current that a module will be able to withstand.

07.2 INVERTER SELECTION AND COMPATIBILITY

When installed as per the IEC standards and regulations, Vikram Solar modules do not normally need to be electrically connected to earth and can operate with either galvanically isolated (with transformer) or transformerless inverters. If galvanically isolated inverters with transformers are used, the negative pole of the array must be connected to earth. If a transformerless inverter is used, the installer should ensure that the right active negative earthing kit is installed by consulting with the inverter supplier. Both methods are required in order to prevent the modules from potential induced degradation in the field.

08. MAINTENANCE AND CARE

Well-designed PV plants require minimum maintenance, however with further maintenance the performance and reliability of the system can be improved.

- Yearly maintenance by a trained professional is usually advised.
- Check that the mounting structures are properly laid and the modules are held tightly in accordance with the mounting instructions given above.
- Ensure that no part of the light collecting area of the module is shaded, any leaves/trees or any object which causes shading must be removed accordingly.
- Ensure all cable assemblies are tight and no part of any cable assembly is exposed to water logging.
- Check that the string fuses in each non-earthed pole are in operation.
- In order to clean PV modules, use a soft module cleaning kit. A soft cloth with mild soft detergent can be used as an alternative. Only use water with the same temperature as that of the module, otherwise thermal shocks can be created and can damage the module. Ensure the module is cleaned without causing any damage such as micro-cracks, etc. to the module.
- Always keep the module clean to ensure maximum power generation from the solar PV module.
- The rear surface of the solar module does not require specific cleaning unless any dirt or debris is stuck on the back sheet. When removing dirt from the back sheet, avoid using any sharp objects, which can damage the substrate material and cause slits.

09. END OF LIFE PRODUCT RECYCLING

After the end of their useful life, products should be recycled in a useful, renewable way. Vikram Solar is a member of the PV Cycle organization, which manages a collection and recycling scheme for end-of-life Solar PV modules throughout Europe and can offer help and support, provided that you submit the serial numbers of the modules.

a) If recycling less than 40 modules, contact PV Cycle directly at http://www.pvcycle.org/ to locate the nearest recycling collection point.

b) To recycle more than 40 modules, contact sales@vikramsolar.com and we will provide support on how to proceed.

10. WARNING

PV modules contain no serviceable parts.

If you have any doubts that your installation is not working properly or may not work properly, please contact your installer immediately.

1) Contact the Vikram Solar sales service team at: sales@vikramsolar.com

2) Submit the customer feedback form to sales@vikramsolar.com, and our technical service representative will get in touch with you shortly.

WARNING:

While performing any electrical maintenance, the system must be completely shut down and such maintenance should be performed by experts. Failure to comply with standards may result in lethal shocks, burns and sometimes even death.